FOOD OF YELLOW PERCH, WHITE BASS, FRESHWATER DRUM, AND CHANNEL CATFISH IN SANDUSKY BAY, LAKE ERIE[1, 2]

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Abstract. Food of yellow perch (*Perca flavescens*), freshwater drum (*Aplodinotus grunniens*), channel catfish (*Ictalurus punctatus*), and white bass (*Morone chrysops*) collected from Sandusky Bay in 1971–72 were recorded and seasonal changes noted. Perch and drum rely on aquatic insect larvae, zooplankton and fish. Catfish were omnivorous feeding on a variety of dipterans, fish and cladocerans. The white bass were generally piscivorous. Each species ate seasonally distinct food based on availability.

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Sandusky Bay, the largest bay contiguous with Lake Erie, is a highly productive area on the Ohio shore of the lake. It has a surface area of 16.5 km^2 and a maximum depth of 4 m (Hartley, 1975). The fish fauna of the bay is abundant and diverse; 74 species have been reported (Willis, 1974). The bay supports important commercial and sport fisheries. The average annual commercial catch from 1938–74 was 1154 metric tons. Although the bay encompasses only 2% of the total surface area of the Ohio waters of Lake Erie, 30% of the total Ohio landings were taken from Sandusky Bay in 1973 and 26% in 1974 (Hartley, 1975). Chapman (1955) estimated annual sport fish landings in excess of 100 metric tons and an annual fishing effort of over 180,000 man days.

Quantitative biological information on Sandusky Bay fish is almost totally lacking, although D. C. Chandler and L. J. Bodenlos (1938) and Hartley (1975) discussed benthos and plankton in detail. Price (1963) discussed food of some fishes in Western Lake Erie but combined bay samples with samples from the adjacent lake area, which masked potential differences.

The bay as an environment for fish and most other aquatic animals is adversely affected by municipal wastes and agricultural runoff. Increased environmental stress through accelerated industrial and residential development of the watershed is anticipated (Hartley, 1975). This stress is indicated by great changes in relative abundance of fish species and a severe decline in species diversity in recent years (Willis, 1974). Given the importance of the fishery to the area, base-line biological information on fishes in the bay is necessary for evaluating future management practices. The objective of our study was to describe the food of four important sport and commercial fish species in Sandusky Bay: yellow perch, *Perca flavescens* (Mitchill); channel catfish, *Ictalurus punctatus* (Raf.); white bass, *Morone chrysops* (Raf.); and freshwater drum, *Aplodinotus grunniens* Raf.

METHODS AND MATERIALS

Fish were collected primarily by bottom trawling at depths of 3 to 4 m along the southern shore of Johnson's Island in Sandusky Bay. Johnson's Island is in the northwest corner of the bay, approximately 1.5 km west of the bay mouth. Samples of each species studied were collected in several 10-min. tows. The trawl, which had an 11 m headrope and a 0.64 cm (bar measure) mesh in the cod end, was fished from

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the 17 m research vessel, *Explorer*, operated by the Ohio Division of Wildlife. Collections were made monthly from April through September 1971 and April through August 1972 (table 1). An additional collection was made by shore seine (2743 m long, 5.1 cm bar mesh) on 11 November 1972, on the south shore of Sandusky Bay east of Bayview, Ohio, midway between the eastern and western ends of the bay approximately 6 km west of Johnson's Island.

TABLE 1

Numbers of fish sampled for food, Sandusky Bay, 1971–72.

Date Collected	Yellow perch	Freshwater drum	Channel catfish	White bass
1971				
17 April	87	—	6	—
15 May	4	—	48	—
25 June	50	—	48	14
19 July	120	—	29	—
20 Aug.	40	—	—	—
22 Sept.	135	—	—	—
1972				
24 April	—	51	16	24
26 May	—	39	34	23
19 June	—	72	22	40
17 July	—	93	21	6
7 Aug.	—	118	67	4
11 Nov.	—	81	—	2
Total fish	436	454	291	113
Size range (mm)	69–277	135–375	103–396	110–395
Total stomachs with food	322	395	263	91

Fish were weighed and measured (total length), and stomachs were removed immediately and preserved in 10% formalin. The point system of Hynes (1950) was used in analyzing the samples. A full, firm stomach was assigned 20 points, but a gorged, distended stomach was allowed up to 30 points. The total points assigned to each stomach were divided among the groups of organisms in the stomach on the basis of estimated volume. Points accumulated by a given type of food in fish from each collection were then divided by the total points in the collection to estimate the percentages. Separate estimates of a sample were frequently derived by more than one person to check precision and were always within ±5% agreement.

All stomach contents were sorted and examined at 30× with a binocular dissecting microscope. Food organisms were identified according to readily recognizable taxonomic groups—usually class or order, although some were identified to species.

RESULTS

Yellow perch fed mainly on dipteran larvae (primarily Chironomidae) and fish (table 2). The emerald shiner, *Notropis atherinoides* Raf., was the most important fish in the diet. Two other groups of organisms were important in individual collections. Cladocerans, primarily *Leptodora kindtii* Focke, were important in July, and copepods contributed about 19% of the food of perch collected in September. Yellow perch shorter than 15 cm were poorly represented in the samples except during June and July, when they contributed 44 and 54% of the samples, respectively.

Freshwater drum showed distinct seasonal differences in their diet. Dipterans were the major food in April and May, and fish in August and November (table 3). Young-of-the-year gizzard shad *Dorosoma cepedianum* (Lesueur), were the principal fish eaten. The length frequency of freshwater drum in all samples was similar.

Channel catfish were omnivorous throughout the collection period. They fed on a variety of food items (table 4), although dipterans, fish, and cladocerans were the main prey. The smallest catfish in the collections was 103 mm long, but most were longer than 200 mm.

Fish, primarily small minnows, were the primary food of white bass (table 5).

TABLE 2

Estimated percentage of total food volume contributed by organisms found in stomachs of yellow perch collected in Sandusky Bay, April through September, 1971.

Food item	Apr.	May	June	July	Aug.	Sept.
Fish	53.2	7.5	5.8	30.9	19.8	12.2
Diptera	37.0	55.0	71.7	19.3	59.3	48.0
Amphipoda	5.6	—	—	—	—	—
Cladocera	—	—	—	49.0	5.7	12.2
Copepoda	—	—	—	—	—	19.4
Unidentified	4.2	37.5	22.5	0.8	15.2	7.6
Total points*	355	20	345	611	413	2108
Total stomachs with food	34	2	41	94	29	122

*Points were assigned according to Hynes (1950). See text for explanation.

Cladocera and Diptera (chironomids) were also important summer food.

DISCUSSION

Britt *et al* (1973) showed evidence of considerable change in the planktonic and benthic communities of western Lake Erie during the last 30 years. Data presented by Chandler and Bodenlos (1938) and Hartley (1975), however, gave no indication of a similar change in Sandusky Bay. Rather, midges and oligochaetes have long been dominant in the benthic community.

Two variables operating during this study that influence the interpretation of food data must be recognized. First, there were marked seasonal differences in the availability of certain food items. Pulses of zooplankton, for example, were reflected in some diets. Cladocerans were unimportant in the diet of all species, except in mid and late summer when the dominant species, *Daphnia galeata mendotae*, becomes abundant (Britt *et al*, 1973). Young-of-the-year fish were more abundant in the diet of all species in late summer, when the young first reached

TABLE 3

Estimated percentage of total food volume contributed by organisms found in stomachs of freshwater drum, Sandusky Bay April through November, 1972.

Food item	Apr.	May	June	July	Aug.	Nov.
Diptera	55.8	45.1	27.8	26.1	26.5	1.5
Amphipoda	4.2	0.8	—	2.9	—	—
Trichoptera	0.8	—	—	—	—	—
Insect exuvia	20.4	12.1	2.3	0.2	0.3	—
Gastropoda	—	—	—	0.6	0.6	—
Cladocera	—	11.5	37.3	61.6	14.3	—
Copepoda	—	0.1	1.3	—	—	—
Crayfish	—	—	—	—	—	0.9
Fish	2.6	—	12.9	5.8	52.8	94.3
Oligochaeta	—	—	2.0	—	—	—
Unidentified	16.2	30.4	16.4	2.8	5.5	3.3
Total points*	505	217	568	830	1647	1133
Total stomachs with food	36	26	64	82	115	63

*Points were assigned according to Hynes (1950). See text for explanation.

TABLE 4

Estimated percentage of total food volume contrbiuted by items found in stomachs of channel catfish, Sandusky Bay, April through July 1971, and April through August 1972.

Food item	1971				1972				
	Apr.	May	June	July	Apr.	May	June	July	Aug.
Cladocera	18.7	—	—	85.9	—	—	0.1	34.6	21.3
Amphipoda	—	<0.1	0.9	—	4.5	—	—	—	—
Pelecypoda	—	—	—	—	—	7.3	—	—	—
Gastropoda	—	22.2	13.3	—	8.4	—	—	6.5	0.3
Diptera	42.5	13.1	34.3	12.8	46.9	39.5	69.7	22.7	65.4
Hemiptera	—	—	7.7	—	—	—	1.7	—	0.4
Coleoptera	—	7.4	8.4	0.7	—	—	—	—	<0.1
Insect exuvia	—	—	3.5	—	3.3	3.6	8.0	0.5	—
Fish	37.5	36.9	9.3	—	30.4	19.8	7.6	35.7	7.0
Algae	—	1.1	—	—	0.2	1.3	0.3	—	1.6
Nematoda	—	—	—	—	—	11.4	2.9	—	2.7
Inorganic debris	—	0.5	—	0.6	—	3.4	—	—	—
Other*	—	1.9	—	—	0.2	—	2.8	—	0.7
Unidentified organics	1.3	16.9	22.6	—	6.1	3.7	6.9	—	0.6
Total points**	80	645	269	230	299	317	240	309	882
Total stomachs with food	4	45	40	27	15	29	21	16	66

*Includes Annelida, Crustacea, Odonata, Ephemeroptera, Orthoptera, and fish eggs.
**Points were assigned according to Hynes (1950). See text for explanation.

suitable size for food. It is assumed that small fish remain a significant part of the diet of all four species throughout the winter, since small yearlings were important items in spring samples.

The second variable is the occasional inclusion of many small fish in some samples, whereas most samples consisted of fish 2 years old or older. This, as well as inclusion of some lake fishes with Sandusky Bay samples by Price (1963), precludes comparison of our data with his. The inclusion of comparatively large numbers of small perch in June and July may have tended to overemphasize the importance of Diptera and Cladocera in

TABLE 5

*Estimated percentage of total food volume contributed by organisms found in stomachs of white bass collected in Sandusky Bay, June 1971 and April through November 1972.**

Food item	1971	1972			
	June	Apr.	May	June	July
Fish	60.0	97.5	27.9	30.4	47.6
Copepoda	—	0.5	—	—	—
Ostracoda	—	—	—	—	1.2
Cladocera	—	—	26.8	39.2	44.1
Diptera	0.5	—	24.8	28.0	7.1
Ephemeroptera	—	—	12.6	2.1	—
Hemiptera	—	—	—	<0.1	—
Insect exuvia	—	—	5.0	<0.1	—
Unidentified	39.5	2.0	2.9	0.2	—
Total points**	50	200	274	552.6	21
Total stomachs with food	7	16	23	33	6

*Four stomachs in August and two in November all contained fish.
**Points were assigned according to Hynes (1950). See text for explanation.

these months respectively. Similarly, the samples of freshwater drum included a very large July sample of yearling fish which consumed a relatively high percentage of cladocerans and a low percentage of fish.

Our data compare favorably with those reported by other authors for these four species. Food of yellow perch typically changes with size and season, but is largely immature insects, larger invertebrates, and fishes in all parts of its range (Nurnberger, 1930; Ewers and Boesel, 1935; Langford and Martin, 1940; Parsons, 1950; Keast and Webb, 1966). Freshwater drum generally eat zooplankton and chironomids as young fish, but as they grow larger, aquatic insects become increasingly important (Scott and Crossman, 1973). Fish appear in the diets of larger drum (Daiber, 1952). Catfish are especially omnivorous (Bailey and Harrison, 1948; Darnell, 1958; Hoopes, 1960), and white bass are carnivorous and piscivorous (Bonn, 1953; Forney and Taylor, 1963; Scott and Crossman, 1973).

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